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OVERVIEW OF THE 2006 HURRICANE SEASON

HEARING

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

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OVERVIEW OF THE 2006 HURRICANE SEASON

WEDNESDAY, JUNE 7, 2006

U.S. SENATE,
SUBCOMMITTEE ON COMMERCE, JUSTICE,
SCIENCE, AND RELATED AGENCIES,
COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:28 a.m., in room SD–192, Dirksen Senate Office Building, Hon. Richard C. Shelby (chairman) presiding.

Present: Senators Shelby, Mikulski, and Murray.

OPENING STATEMENT OF SENATOR RICHARD C. SHELBY

Senator SHELBY. Good morning. This hearing will come to order.

We are here to discuss the important upcoming hurricane season. This is an important topic, and one that will get considerable attention in the months ahead as we reflect on the devastating 2005 hurricane season.

We're pleased to have with us today the Under Secretary of Commerce for Oceans and Atmosphere, Vice Admiral Conrad Lautenbacher. He is joined by Dr. Louis W. Uccellini, the Director of the National Weather Service, National Centers for Environmental Prediction. Thank you both for appearing before the subcommittee.

I would like to extend my appreciation to Dr. Uccellini, who is making a last-minute appearance, as Max Mayfield was unable to join us.

I would like to begin by commending NOAA for its work surrounding last year's hurricanes. Predictions for Hurricane Katrina were especially well prepared, and undoubtedly saved countless lives. The work that goes into forecasting these storms should not be taken for granted. Congress recognizes the extraordinary effort and critical expertise NOAA provides the Nation. Emergency coordination after the storm is critical to helping our coastal communities. When it came to post-hurricane support, NOAA was one of the Federal agencies that provided quick, competent response on the water, in the air, and on the ground.

The Office of Coast Survey mapped the ports for the purpose of safe navigation so they could reopen quickly. NOAA's Cessna Citation aircraft flew two to three missions each day, stopping only to refuel, to provide aerial photography of the affected areas. The National Weather Service provided emergency responders with realtime weather updates directly from the local weather offices to those in the field.

The Office of Response and Restoration continues to help coordinate and mitigate marine debris removal. These services directly helped local and State emergency responders immediately following the hurricanes.

As we enter the 2006 hurricane season, the subcommittee will be looking for you to use the lessons learned from last year to make good decisions this year. We're very interested in hearing about the communication and coordination shortfalls you had identified during your post-hurricane evaluations last year, how you have prepared to overcome those challenges now, and what additional measures need to be taken to address any future challenges that NOAA recognizes may be problematic. Only by generating a systematic and clear list of your needs can Congress better serve you.

Gentlemen, we look forward to your testimony today. All of your written testimony will be made part of the record.

Senator Mikulski.

STATEMENT OF SENATOR BARBARA A. MIKULSKI

Senator MIKULSKI. Thank you very much, Mr. Chairman. And I want to thank you for your leadership in conducting this hearing. Because you and I are coastal Senators, we are absolutely, of course, directly impacted by hurricanes. What you lived through in the gulf, along with our colleagues, was stunning.

I, too, want to welcome Admiral Lautenbacher, Dr. Uccellini. Why do I know how to say his name? He's a Maryland constituent.

Senator SHELBY. You're doing better than I'm doing.

Senator MIKULSKI. Well, if you can get through Mikulski, you get to Uccellini.

And, also, we wish Max Mayfield, the head of the Hurricane Prediction Center, well. We want to compliment NOAA on the fact that, at the Hurricane Prediction Center, they have a familiar and trusted voice. We've heard Mr. Mayfield over the years, and I think all of America knows, when we need to know about hurricanes, it comes out of one place, one voice, and that voice is viewed as trusted. And we need to make sure that's happening.

This is a very timely hearing, because it's the first week of hurricane season, which will go from now until mid-October. NOAA, alarmingly, predicted that 2006 will be very active. Up to six hurricanes could be a category 3. What we need to make sure is that we have the most accurate prediction. Better prediction means better protection. And we know our mutual motto is, "Saving lives and saving properties." We know that it only takes one hurricane to devastate a community.

Mr. Chairman, on Monday I visited NOAA's National Centers for Environmental Prediction, in Camp Springs, Maryland, in Prince George's County. It's a tremendous national asset, developing and operating models for forecasters to predict where hurricanes will make landfall, how intense that hurricane is, and how—what is the surge, to predict how much flooding could either come up my bay, the gulf coast, or inland flooding. The models that they develop there are the roadmaps for weather forecasters nationwide. Without the experts in Camp Springs, the Hurricane Center cannot do its job. So, it's very important that—and if you went out there, you see that they're working on hurricanes, helping predict the condi-

tions that could precipitate the wildfires, and many others. It is, kind of, the brain center, with the supercomputing model being—the supercomputer being in Gaithersburg. Why is that good? Well, not only do—am I proud that it's in my State, but they are literally out of, in many ways, harm's way of a hurricane. So, people think the Hurricane Center is in Miami, but that's in harm's way, and, as you know, from Katrina, when our own defenders and predictors go down, then there's only more vulnerability.

So, today we need to know, How good are we at predicting, what we can do to work with you. What—I will tell you, what I was so impressed with was, sure, I saw new mathematical models; sure, I saw innovative technology; but, Mr. Chairman, what I saw were people—forecasters, mathematicians, all types of scientists—who read and analyze data. And we're lucky to be able to recruit them, and we need to also focus on how we can retain them. We need to make that weather service better, faster, stronger. They've got the will. Now let's you and I work together to find the wallet.

I look forward to hearing the testimony.

Senator SHELBY. Thank you, Senator Mikulski.

Admiral, we'll start with you.

STATEMENT OF VICE ADMIRAL CONRAD C. LAUTENBACHER, JR. (USN, RET.), UNDER SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE; AND ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

ACCOMPANIED BY DR. LOUIS W. UCCELLINI, DIRECTOR, NATIONAL CENTERS FOR ENVIRONMENTAL PREDICTION, NATIONAL WEATHER SERVICE, DEPARTMENT OF COMMERCE

Admiral LAUTENBACHER. Thank you, Mr. Chairman.

Senator SHELBY. Proceed as you wish.

Admiral LAUTENBACHER. Yes, sir.

Thank you very much, Mr. Chairman and ranking member, Senator Mikulski, and distinguished members of the subcommittee and the staff. We appreciate the opportunity to appear before you and discuss the topic of the day.

First let me express my regrets for Max Mayfield, who could not be here today. We appreciate you giving him a bye. He has bronchitis, and we want to make sure he's ready for the season.

But I have with me today, as you mentioned, Dr. Louis Uccellini—we'll just call him Louis—the head of the National Weather Service, National Centers for Environmental Prediction.

Senator SHELBY. I think we have his name down now, Uccellini.

OPENING STATEMENT

Admiral LAUTENBACHER. But, as we all know, Max is well known by the public, but this man should be just as well known, because his work—he's really the head of the brain of NOAA, in terms of providing the weather forecasts that go out all over the Nation to all of our forecast offices. So, every prediction that you see out there in forecast has a bit of Louis in it, in the work that he does. So, it's a very important role that he plays, and he does it well, and I'm proud to be associated with this organization and the people who work in NOAA. They are very dedicated, talented individuals.

I also want to express my gratitude to you and the subcommittee for your support and hard work on our behalf. It has allowed us to continue to support the Nation, as required, and we're very, very grateful for the kinds of support and interest that we have from this subcommittee. For instance, the hurricane supplemental funding that was approved recently has been fully distributed and is now being used, as directed. It includes funding for forecast model improvements, storm surge and inland hurricane forecasting improvements, and the procurement of an additional Hurricane Hunter aircraft. Thank you, again, for your support. This support will make a big difference in our ability to improve our forecasts for the future.

HURRICANE-RELATED SUPPORT

Just a couple of comments on the—on last year's season, because of its record-breaking issues, in many ways. From our perspective, hurricane forecasts for Katrina and Rita were some of the most accurate ever for storm track, size, intensity, surge, and warning leadtime, allowing for evacuation of 85 to 90 percent, or more, of the Texas and Louisiana coasts. And while Katrina and Rita are blamed for over 1,200 deaths, it may well have been much, much worse, as we all know.

And, as the chairman mentioned, our work does not end with the forecasts. We immediately responded, after the destructive hurricanes had passed, by providing the aerial images, by providing realtime storm tide-level information to emergency responders, employing satellite imagery to determine coastal impacts, assessing the hazardous materials spills, surveying critical ports and waterways, redirecting NOAA ships to impacted areas, and contributing $4.3 million from our budget to States for environmental enforcement after the event.

Our wide-ranging capabilities continue to support the impacted areas even now, with response to spills, maritime incidents, rebuilding fisheries, and delivering consistent and timely geodetic height information very important to restoration. NOAA can, and will, continue to bring more to the table than just our forecasts. And, again, your continued support of NOAA, across the board, is critical to our ability to add value to science for the American people, and we appreciate the total support that NOAA gains from this subcommittee.

2006 ATLANTIC HURRICANE SEASON OUTLOOK

Now, for the 2006 Atlantic hurricane season, everywhere we go, this is an important question. People want to know how many hurricanes there will be, and if one will hit their area. The news media—and this hearing, I might add—also gives our seasonal forecasts high visibility, helping to raise awareness about the threat of hurricanes. I thank you, again, for this opportunity to raise that awareness.

The official season, as mentioned, started June 1, and goes through November 30, with the average peak of hurricane activity occurring with the warmest water temperatures, from mid-August to late October. Our prediction for this year's Atlantic hurricane season is for 13 to 16 tropical storms, with 8 to 10 becoming hurri-

canes, of which 4 to 6 could become major hurricanes. For comparison, on average, the North Atlantic hurricane season produces 11 named storms, with 6 becoming hurricanes, including 2 major hurricanes. A major hurricane is a storm category 3 or higher on the Saffir-Simpson hurricane scale, which means winds greater than 110 miles per hour. Major hurricanes cause about 80 percent of the damage sustained from tropical cyclones. This year's forecast has an 80 percent likelihood of an above-average number of storms in the Atlantic basin. That's the highest level of confidence we've had in a number of years.

Our forecast for this season is based primarily on the continuing multidecadal signal in the global tropics. This year, the signal indicates favorable atmospheric—including wind and pressure patterns—and oceanic—warm sea-surface temperature—conditions for hurricane formations.

Another question that is frequently raised is the role climate change plays in hurricane frequency and intensity. This is an extremely important issue to NOAA. Our meteorologists and research scientists in several areas of our organization are actively engaged in ongoing research to better understand how climate variability and change may impact hurricane frequency and intensity.

Last year was a record-setting season: 28 storms, 15 hurricanes, of which 7 became major. We saw, all too vividly, the destruction and devastation hurricanes can cause. This is why it is important not to focus only on the total number of storms. The message is that we all need to be prepared.

MULTI-DECADAL CLIMATE PATTERNS

We have observed that steering patterns for major hurricane landfalls can sometimes persist over several years. During the 1940s, many major hurricanes hit Florida. During the 1950s, the focus of landfalling hurricanes shifted to the U.S. east coast. And during the 1960s, the central and western gulf coast were slammed by several hurricanes. This pattern might lead someone to assume, given the recent major hurricanes, like Charley, Ivan, Jean, Dennis, Katrina, Rita, and Wilma in the last 2 years, that Florida and the gulf coast are likely targets again this season. However, there are always exceptions, and it only takes one hurricane, over a given community, to make it a bad year.

In 1983, for instance, there was only one landfalling hurricane in the United States, but it was category 3 Hurricane Alicia, which hit the Galveston and Houston area. And in 1992, we likewise, had only one hurricane. That was category 5 Hurricane Andrew. The point of this is that no one can tell us reliably, months in advance, when or where hurricanes are going to strike. The state of science is simply not advanced enough at this time to do that. The bottom line is that all coastal States, from Texas to Maine, including Alabama and Maryland, Hawaii, and other U.S. interests in the Pacific and the Caribbean, are vulnerable to the devastation brought by a hurricane. Our message is consistent. We want every business, every family, every individual, and every community on or near the coast to have a hurricane preparedness plan, and have it in place at the start of the hurricane season.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION EFFORTS TO IMPROVE HURRICANE PREDICTIONS

Now, improving hurricane forecasting is a top priority for the administration. NOAA has made great strides in improving our hurricane track forecasting. Our 5-day forecasts are now as accurate as 3-day forecasts were 15 years ago. NOAA spends over $300 million per year to track and forecast hurricanes. For 2007, we are requesting $109 million in increases for hurricane-related investments. We are focusing our hurricane efforts on improving hurricane track and intensity forecasting through improved observations, modeling, and the continuation of a very effective method called "joint hurricane testbeds."

Our equipment is also critical. NOAA aircraft, the P–3 Orions and the Gulf Stream IV, provide essential observations and data critical to the National Hurricane Center forecasters and supplement the U.S. Air Force reconnaissance flights. The $14.2 million that NOAA received in the 2006 supplemental appropriations to improve future aircraft service will add an additional P–3 next year and upgrade the radar and instrumentation on all of NOAA's aircraft, an important investment.

HURRICANE PREPARATION

We encourage everyone to prepare. We work year-round with Federal, State, and local emergency managers. We educate them about weather effects from hurricanes, and they educate us about response issues and their challenges. It is a constant learning process, and the key is working together to ensure the public takes appropriate action.

Most preparedness activity and outreach take place outside the hurricane season. Last month, as part of our ongoing mission to enhance economic security and national safety, NOAA led a hurricane awareness tour along the gulf coast. The tour helped raise awareness about the potential effects from a hurricane landfall with the Federal Emergency Management Agency (FEMA), local governments, emergency managers, schools, the public, and the media, in a team effort to increase hurricane awareness and encourage preparedness in this vulnerable area of the Nation.

During landfalling storms, it is essential for the emergency management community and the weather community to have one message for the public so that businesses and people can take appropriate action. Nowhere is this more critical than in areas most vulnerable to the impact of a hurricane.

In conclusion, the truth is no one knows exactly what areas of the coast, or which States, or locations within those States, if any, will be impacted by hurricanes in 2006. Could it be Florida again? Maybe. How about New England or New York City? That's possible, but, right now we just do not know. We also need to remember that a hurricane is not just a coastal event. The strong winds, heavy rains, and tornados from weakening tropical systems can spread well inland and cause tremendous damage.

Having said that, Katrina is a grim reminder that the greatest potential for large loss of life is from the storm surge near the coast. The bottom line is that all coastal States and territories are

at risk. Everyone along the coast must be prepared well in advance to protect their lives and property in the event of a hurricane.

Again, thank you to the subcommittee for your support and your interest in holding this hearing. We are ready to answer your questions.

Thank you, sir.

[The statement follows:]

PREPARED STATEMENT OF VICE ADMIRAL CONRAD C. LAUTENBACHER, JR.

Chairman Shelby, Ranking Member Mikulski and Members of the Committee, I am Conrad C. Lautenbacher, Jr., Under Secretary for Oceans and Atmosphere and Administrator of the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce (DOC). I am joined by Dr. Louis Uccellini, Director of NOAA's National Weather Service, National Centers for Environmental Prediction. Thank you for inviting us here today to discuss the outlook for the 2006 Hurricane Season, and to talk about what we can each do to be best prepared to protect lives and livelihoods in the event of a hurricane.

First, let me express my sincere gratitude to the members of this Committee. Your continued support of NOAA and our hurricane program enables us to make the best forecasts possible, helping ensure the people of our Nation understand the potential impacts from hurricanes and what they can do to protect their life and property. The fiscal year 2006 Hurricane Supplemental Funding approved by Congress has been fully distributed and is being used as directed, including funding forecast model improvements, storm surge and inland hurricane forecasting improvements, and the procurement of an additional Hurricane Hunter aircraft. Thank you again for your support.

NOAA PROVIDED CRITICAL INFORMATION AND SUPPORT BEFORE AND AFTER THE 2005 HURRICANES

Before I discuss the details of the 2006 hurricane outlook, I would like to briefly highlight one of NOAA's most notable successes in recent memory—our performance during the 2005 season.

Among our many hurricane-related missions, NOAA has the primary responsibility to provide weather data, forecasts and warnings for the United States and its territories. NOAA's forecasts and warnings for Hurricane Katrina and Hurricane Rita pushed the limits of state-of-the-art hurricane prediction. NOAA's National Weather Service (NWS) operates the most advanced weather and flood warning and forecast system in the world, helping to protect lives and property and enhance the national economy. In partnership with the Department of Defense, NASA, the National Science Foundation, other federal agencies, and the academic community, the long-term continuous research efforts, including observations, modeling, and expanded computational resources have led to NOAA's current predictive capabilities and improved ways of describing uncertainty in prediction. Reconnaissance data from NOAA and Air Force Reserve aircraft provided critical data NOAA forecasters used for their accurate hurricane predictions. Hurricane forecasts for Katrina and Rita were some of the most accurate ever for storm track, size, intensity, surge, and warning lead time, allowing for evacuation of 85–90 percent or more of the Texas and Louisiana coasts. While Katrina and Rita are blamed for over 1,200 deaths, it may well have been much, much worse.

But NOAA's work does not end with the forecast. This was particularly evident last August, when NOAA responded immediately to the destructive hurricanes in several ways. NOAA provided over 9,500 aerial images of the impacted coastline to help emergency responders assess the situation, analyzed satellite imagery to determine the coastal impacts, and sent Scientific Support Coordinators to address nearly 400 hazardous material spills. We also sent Navigation Response Teams to survey for obstructions to navigation in critical ports and waterways to allow relief supplies to be delivered and maritime commerce to resume. NOAA ships THOMAS JEFFERSON and NANCY FOSTER were diverted from planned missions to areas impacted by the hurricanes and helped collect data needed to reopen critical Gulf Coast ports and to assess impacts on Gulf Coast ports and fisheries. Immediately following the storms, NOAA contributed $4.3 million to the States to assist with environmental enforcement and search-and-rescue. Readings from NOAA's National Water Level Observation Network (NWLON) tide stations in the region provided emergency responders with real time storm tides, and are now invaluable data that can be used in planning the rebuilding of the coast.

NOAA's wide-ranging capabilities continue to support the impacted areas with response to spills and maritime incidents. NOAA invested more than $3.7 million in 2005 grant funding to Gulf States to build, and in some cases re-build, their infrastructure and capacity to determine and deliver consistent and timely geodetic height information. Accurate land and water level heights are critical to determining effective highway evacuation routes, levee heights, storm surge modeling, flood plain mapping, sea level rise calculations, vessel under-keel and bridge clearance, subsidence monitoring, and restoration of coastal habitats. So, as you see, NOAA can and will continue to bring more to the table than just our forecasts. Your continued support of NOAA across the board is critical to our ability to add value to science for the American people.

2006 ATLANTIC HURRICANE SEASON OUTLOOK

Everywhere we go we are asked about the forecast for this hurricane season. People want to know how many hurricanes there will be and if one will hit their area. The media also gives these seasonal forecasts high visibility, and this can have a very positive effect because it raises awareness about the threat from hurricanes and encourages businesses and people to prepare for what might happen.

The official hurricane season started June 1st and goes through November 30th, with the average peak of hurricane activity occurring with the warmest water temperatures, from mid-August to late October. NOAA's prediction for the 2006 Atlantic hurricane season is for 13–16 tropical storms, with eight to 10 becoming hurricanes, of which four to six could become major hurricanes. A major hurricane is a storm Category 3 or higher on the Saffir-Simpson hurricane scale, with winds greater than 110 miles per hour. Major hurricanes cause about 80 percent of the damage sustained from tropical storms. We are predicting an 80 percent likelihood of an above average number of storms in the Atlantic Basin this season. This is the highest percentage we have ever issued. Our forecast for this season is based primarily on the continuing Multi-Decadal Signal in the global tropics—a climate pattern that has been in place since 1995. Since the mid-1990s, nine of the last 11 hurricane seasons have been above normal, with only two below normal seasons during the El Niño years of 1997 and 2002. This Multi-decadal signal will likely keep us in an active period for major hurricanes for another 10 to 20 years or more.

Warmer ocean water temperatures in the tropical Atlantic Ocean and Caribbean combined with expected weaker easterly trade winds and a more favorable wind pattern in the mid-levels of the atmosphere are factors that collectively will favor storms in greater numbers and greater intensity. Warm water is the energy source for storms while favorable wind patterns limit the wind shear that can tear apart a storm's building cloud structure.

NOAA is actively engaged in ongoing research to understand how climate variability and change may affect hurricane frequency and intensity. For example, climate effects from outside the Atlantic basin, such as El Niño/Southern Oscillation (ENSO), can impact hurricane formation in the Atlantic Basin. This year, however, NOAA scientists predict neutral ENSO conditions, which means neither El Niño conditions (which tend to suppress hurricane formation) nor La Niña conditions (which tend to favor hurricane formation) will be a factor in this year's hurricane season.

Last year was a record-setting hurricane season, with 28 storms and 15 hurricanes, of which seven were major hurricanes. We saw all too vividly the destruction and devastation individual hurricanes can cause. This is why it is important not to focus only on the total number of storms. The message is clear. We all need to be prepared.

MULTI-DECADAL CLIMATE PATTERNS

As mentioned above, we have observed that steering patterns for major hurricane landfalls can sometimes persist over several years. During the 1940s many major hurricanes hit Florida. During the 1950s, the focus of land falling hurricane shifted to the U.S. East Coast. During the 1960s, the central and western Gulf Coast were slammed by several hurricanes.

This pattern might lead one to assume that—given the recent major hurricanes like Charley, Ivan, Jeanne, Dennis, Katrina, Rita and Wilma in 2004 and 2005—Florida and the Gulf Coast are likely targets again this season. However, in each of these decades there were exceptions. For example, in the 1940s, while most storms hit Florida, two made landfall in the Gulf, and one made landfall in New England. In addition, in the 1930s, major land falling hurricanes were relatively well distributed along the U.S. coastline—hitting the U.S. coast from Texas to New England. Consequently, while it is possible to observe these trends and make gen-

eralizations based upon these observations—it is important to understand that in any given year a hurricane can impact any part of the U.S. coastline from Texas to Maine. Coastal communities along the Gulf and East Coasts (in addition to Hawaii and other interests in the Pacific and Caribbean) remain at risk for hurricanes, and the business community and the public must be prepared to respond if a situation arises.

It only takes one hurricane over a given community to make for a bad year. In 1983, there was only one landfalling hurricane in the United States, but it was Category 3 Hurricane Alicia which hit the Galveston/Houston area. And in 1992, we only had one hurricane make landfall in the United States, but that was Category 5 Hurricane Andrew, which hit southern Miami-Dade County, Florida.

No one can tell us reliably, months in advance when or where hurricanes are going to strike. The state of the science is simply not advanced enough at this time to do that. The bottom line is that all coastal states from Texas to Maine, Hawaii, and other U.S. interests in the Pacific and the Caribbean are vulnerable to the devastation brought by a hurricane. The message from NOAA is very consistent. We want every business, every family, every individual, and every community on or near the coast to have a hurricane preparedness plan and have it in place at the start of hurricane season.

NOAA EFFORTS TO IMPROVE HURRICANE PREDICTIONS

Improving hurricane forecasting is a top priority for the Administration. NOAA has made great strides in improving hurricane track forecasting; our 5-day forecasts are now as accurate as 3-day forecasts were 15 years ago. NOAA spends over $300 million per year to track and forecast hurricanes. In fiscal year 2007, we are requesting $109 million in increases for hurricane-related investments.

NOAA is focused on improving hurricane track, intensity, storm surge, and rainfall predictions. The accuracy of NOAA's hurricane forecasts is closely tied to improvements in computer-based numerical weather prediction models. This year NOAA implemented advances in its hurricane forecasting model that are expected to yield improved track and intensity guidance for our forecasters. The Geophysical Fluid Dynamics Laboratory in NOAA's Office of Oceanic and Atmospheric Research (OAR) developed this hurricane model and incorporated it into operations at NWS's National Center for Environmental Prediction (NCEP).

NOAA's Central Computer System upgrade in fiscal year 2007 will increase computational speed, memory, and storage capabilities. This allows more sophisticated numerical models to run and make use of available data, including data from NOAA's polar orbiting and geostationary satellites. We expect significant improvements in intensity, precipitation and wind distribution forecasting from the next generation operational modeling system.

Predicting hurricane intensity remains one of our most difficult forecast challenges. We are all aware of the improvements made in predicting hurricane track forecasts and this has been where NOAA and the research community have, in the past, placed their emphasis. Within the past few years, the emphasis on improving intensity prediction has increased. Leading the way, in fiscal year 2007 NOAA plans to introduce a new hurricane modeling system developed by NCEP's Environmental Modeling Center called the Hurricane Weather Research and Forecasting model (HWRF).

Congress supported this effort in the fiscal year 2006 Hurricane Supplemental Funding, and HWRF implementation and development is included in the fiscal year 2007 President's Budget request. The HWRF will be a coupled atmosphere-ocean prediction system that will take advantage of the latest atmosphere and ocean observations, the most advanced methods to analyze those data, and state of the art physics to produce our Nation's next generation hurricane forecast system. Once the HWRF becomes operational, our goal is to improve hurricane intensity predictions by about 30 percent by 2015.

Hurricane Katrina is a grim reminder that the greatest potential for economic destruction and large loss of life is from the storm surge near the coast. Storm surge is also very difficult to predict because it depends on the hurricane track and wind field, but it also is impacted by bathymetry and natural and man-made barriers, such as dunes and roadways. A slight difference in track or wind field can mean a huge difference in where the highest storm surge impacts the coast.

We believe the NOAA Storm Surge Model, known as SLOSH (Sea, Lake and Overland, Surge from Hurricanes) provided excellent guidance during last year's hurricanes. We realize many other storm surge models exist, and NOAA recently formed an assessment team to re-examine our users' requirements for real-time

storm surge information and products, to direct storm surge modeling within NOAA, and to plan for future enhancement of, or the replacement of, the SLOSH model.

NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) Hurricane Research Division (HRD) also conducts research to better understand internal storm dynamics and interactions between a hurricane and the surrounding atmosphere and ocean. AOML's scientists provide data and information to operational NOAA forecasters for use in models. Through a greater understanding of physical processes and advanced hurricane modeling, in collaboration with federal partners, academic researchers, and commercial enterprises, NOAA continually improves models for predicting hurricane intensity and track.

To help guide future research efforts, NOAA's Science Advisory Board commissioned a Hurricane Intensity Research Working Group to provide recommendations to the agency on the direction of hurricane intensity research. The Working Group expects to transmit its final report to the Science Advisory Board in July 2006. The National Science Board of the National Science Foundation has also convened a working group of external advisors to review hurricane science and engineering. The final report from this group is scheduled to be submitted to the National Science Board in August 2006. Recommendations from these reports will be carefully considered by NOAA as we plan our efforts to improve our operations and predictions.

AIRCRAFT RECONNAISSANCE DATA

NOAA aircraft, the W–P3 Orions and the Gulf Stream IV, provide essential observations critical to the National Hurricane Center forecasters and supplement the U.S. Air Force Reserve Command's 53rd Weather Reconnaissance Squadron flights. The $14.2 million NOAA received in fiscal year 2006 supplemental appropriations to improve future aircraft service will add an additional W–P3 next year, and upgrade the radar and instrumentation on all of NOAA's aircraft.

A specialized instrument flown on the W–P3s, the Stepped Frequency Microwave Radiometer (SFMR), was developed by NOAA researchers at AOML and provides essential data on hurricane structure, surface wind and rain rate to hurricane forecasters. The SFMR allows forecasters and researchers to see fluctuations in hurricane intensity not observed before. The Military Construction Appropriations and Emergency Hurricane Supplemental Appropriations Act, 2005 (Public Law 108–324) provided $10.5 million to the Air Force to outfit the complete fleet of Hurricane Hunters with this instrument. We hope the first of these additional units will be available toward the end of the 2006 Hurricane Season.

NOAA ENCOURAGES EVERYONE TO PREPARE

We work year-round with federal, state, and local emergency managers; we educate them about weather effects from hurricanes and they educate us about response issues and their challenges. It is a constant learning process and the key is working together to ensure the public takes appropriate action. Most preparedness activity and outreach takes place outside hurricane season. Last month, as part of our ongoing mission to enhance economic security and national safety, NOAA led a Hurricane Awareness Tour along the Gulf Coast. The tour helped raise awareness about the potential effects from a hurricane landfall. The National Weather Service forecast offices arranged the tour events with the Federal Emergency Management Agency, local governments, emergency managers, schools, the public and the media in a team effort to increase hurricane awareness and encourage preparedness in this vulnerable area of the nation. During land falling storms, it is essential for the emergency management community and the weather community to have one message for the public so businesses and people can take appropriate action. Nowhere is this more critical than in areas most vulnerable to the impact of a hurricane.

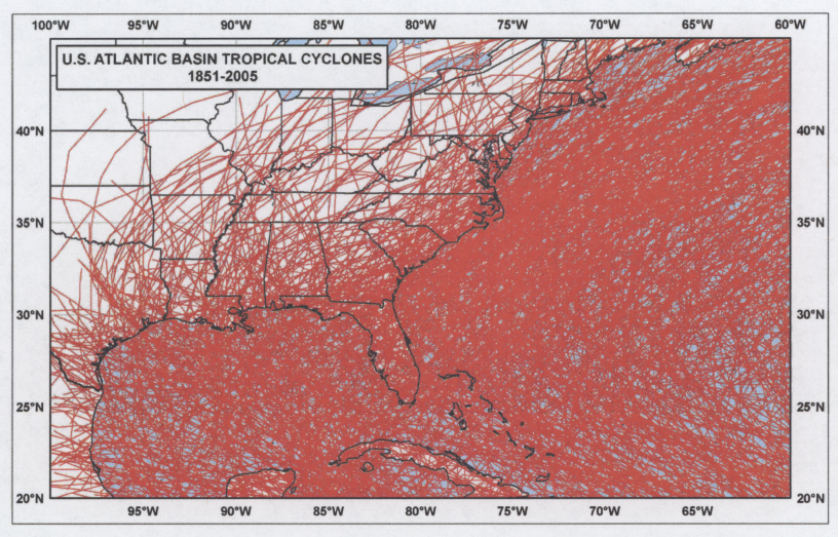
While NOAA will continue to do its best to provide as much warning as possible, it is my hope that each business, each family, and each community, on or near the coast, will develop and be able to execute a hurricane preparedness plan. We must all be ready to protect our lives and property from the power of hurricanes.

CONCLUSION

The truth is, right now, no one knows exactly what areas of the coast, or which states or locations within those states, if any, a hurricane will hit in 2006. Could it be the Gulf Coast again? Maybe. How about New England or New York City? That's possible, but, right now we just don't know. We also need to remember a hurricane is not just a coastal event. The strong winds, heavy rains and tornadoes from weakening tropical systems can spread well inland and cause tremendous damage.

The chart below shows the tracks of tropical storms and hurricanes since 1851. I think most people can look at this graphic and understand that the United States

is vulnerable to hurricanes. The bottom line is that all coastal states from Texas to Maine, Hawaii, and other U.S. interests in the Pacific and the Caribbean are at risk. Everyone along the coast, including inland communities, must be prepared to protect their lives and property in the event of a hurricane. Thank you.



BIOGRAPHICAL SKETCH OF CONRAD C. LAUTENBACHER, JR.

A native of Philadelphia, Pa., retired Navy Vice Admiral Conrad C. Lautenbacher, Ph.D., is serving as the Under Secretary of Commerce for Oceans and Atmosphere. He was appointed Dec. 19, 2001. Along with this title comes the added distinction of serving as the eighth Administrator of the National Oceanic and Atmospheric Administration. He holds an M.S. and Ph.D. from Harvard University in applied mathematics.

Lautenbacher oversees the day-to-day functions of NOAA, as well as laying out its strategic and operational future. The agency manages an annual budget of $4 billion. The agency includes, and is comprised of, the National Environmental Satellite, Data and Information Services; National Marine Fisheries Service; National Ocean Service; National Weather Service; Oceanic and Atmospheric Research; Marine and Aviation Operations; and the NOAA Corps, the nation's seventh uniformed service. He directed an extensive review and reorganization of the NOAA corporate structure to meet the environmental challenges of the 21st century.

As the NOAA Administrator, Lautenbacher spearheaded the first-ever Earth Observation Summit, which hosted ministerial-level representation from several dozen of the world's nations in Washington July 2003. Through subsequent international summits and working groups, he worked to encourage world scientific and policy leaders to work toward a common goal of building a sustained Global Earth Observation System of Systems (GEOSS) that would collect and disseminate data, information and models to stakeholders and decision makers for the benefit of all nations individually and the world community collectively. The effort culminated in an agreement for a 10-year implementation plan for GEOSS reached by the 55 member countries of the Group on Earth Observations at the Third Observation Summit held in Brussels February 2005.

He also has headed numerous delegations at international governmental summits and conferences around the world, including the U.S. delegation to 2002 Asia-Pacific Economic Cooperation Ocean Ministerial Meeting in Korea, and 2002 and 2003 meetings of the World Meteorological Organization and Intergovernmental Oceanographic Commission in Switzerland and France, as well as leading the Commerce delegation to the 2002 World Summit on Sustainable Development in South Africa.

Before joining NOAA, Lautenbacher formed his own management consultant business, and worked principally for Technology, Strategies & Alliances Inc. He was

president and CEO of the Consortium for Oceanographic Research and Education (CORE). This not-for-profit organization has a membership of 76 institutions of higher learning and a mission to increase basic knowledge and public support across the spectrum of ocean sciences.

Lautenbacher is a graduate of the U.S. Naval Academy (Class of 1964), and has won accolades for his performance in a broad range of operational, command and staff positions both ashore and afloat. He retired after 40 years of service in the Navy. His military career was marked by skilled fiscal management and significant improvements in operations through performance-based evaluations of processes.

During his time in the Navy, he was selected as a Federal Executive Fellow and served at the Brookings Institution. He served as a guest lecturer on numerous occasions at the Naval War College, the Army War College, the Air War College, The Fletcher School of Diplomacy, and the components of the National Defense University.

His Navy experience includes tours as Commanding Officer of USS HEWITT (DD–966), Commander Naval Station Norfolk; Commander of Cruiser-Destroyer Group Five with additional duties as Commander U.S. Naval Forces Central Command Riyadh during Operations Desert Shield and Desert Storm, where he was in charge of Navy planning and participation in the air campaign. As Commander U.S. Third Fleet, he introduced joint training to the Pacific with the initiation of the first West Coast Joint Task Force Training Exercises (JTFEXs).

A leader in the introduction of cutting-edge information technology, he pioneered the use of information technology to mount large-scale operations using sea-based command and control. As Assistant for Strategy with the Chief of Naval Operations Executive Panel, and Program Planning Branch Head in the Navy Program Planning Directorate, he continued to hone his analytic skills resulting in designation as a specialist both in Operations Analysis and Financial Management. During his final tour of duty, he served as Deputy Chief of Naval Operations (Resources, Warfare Requirements and Assessments) in charge of Navy programs and budget.

Lautenbacher lives in Northern Virginia with his wife Susan who is a life-long high school and middle school science teacher.

BIOGRAPHICAL SKETCH OF DR. LOUIS W. UCCELLINI

Dr. Louis W. Uccellini is currently the Director of the National Weather Service, National Centers for Environmental Prediction (NCEP). In his position, he is responsible for directing and planning the science, technology and operations related to NCEP's Central Operations and Environmental Modeling Center as well as seven national centers that forecast specific weather phenomena. These centers include the National Hurricane Center (Miami, FL), Storm Prediction Center (Norman, OK), Space Environment Center (Boulder, CO), Ocean Prediction Center, Hydrometeorological Prediction Centers, Climate Prediction Center and Aviation Weather Center (Kansas City, MO).

Prior, Dr. Uccellini was the Director of the NWS Office of Meteorology from 1994 to 1999; Chief of the NWS Meteorological Operations Division from 1989 to 1994; and Section Head for the Mesoscale Analysis and Modeling Section in the Goddard Space Flight Center's Laboratory for Atmospheres from 1978 to 1989.

He received his Ph.D. (1977), Masters (1972) and Bachelor of Science (1971), degrees from the University of Wisconsin-Madison. Dr. Uccellini has published more than 55 journal articles and chapters in books on subjects including analysis of severe weather outbreaks, snowstorms, gravity waves, jet streaks, cyclones and the use of satellite data in analysis and modeling applications. He is the co-author of a widely acclaimed book entitled Snowstorms Along the Northeastern Coast of the United States: 1955 to 1985, which was published by the American Meteorological Society in 1990; and authored a chapter in the 1999 AMS publication The Life Cycles of Extratropical Cyclones that provides a historical review of advances in forecasting extratropical cyclones at NCEP. Also in the Fall of 2004, a new two-volume book: Northeast Snowstorms, co-authored by Dr. Uccellini, was published by the American Meteorological Society.

Dr. Uccellini has received numerous awards in recognition of his research and operational achievements including the Maryland Academy of Sciences Distinguished Young Scientist Award (1981), the NASA Medal for Exceptional Scientific Achievement (1985), the American Meteorological Society's prestigious Clarence Leroy Meisinger Award (1985), and the National Weather Association's Research Achievement Awards for Significant Contributions to Operational Meteorology (1996). He was elected as a Fellow to the AMS in 1987, and received the U.S. Presidential Meritorious Executive Rank Award in 2001.

Senator SHELBY. Dr. Uccellini. Is that right?

Admiral LAUTENBACHER. No, he's just asking you if that's the right pronunciation.

Dr. UCCELLINI. Yes, it is. Dr. Uccellini.

Senator SHELBY. Uccellini.

Dr. UCCELLINI. Right.

Senator SHELBY. Uccellini. I thought the Senator from Maryland would certainly get it right. Go ahead.

STATEMENT OF DR. LOUIS UCCELLINI

Dr. UCCELLINI. Well, most of my comments would be included in what you've just heard.

I'll just say, with respect to the National Centers for Environmental Prediction, that the National Hurricane Center is one of seven service centers. I like to tell my family that, with Max Mayfield, when they see him on TV—they ask who he works for, and I tell them that we all work for Max, although on paper he reports to me.

The National Centers provide the model, the IT infrastructure, to ensure that the National Hurricane Center works on time, every time. And, in that light, we also provide the critical backup to the National Hurricane Center. This was an issue last year, as we dealt with Hurricane Wilma, that crossed right over the Center. So, it is an issue we take very seriously.

With respect to the past year and lessons learned, I want to assure you that all the model upgrades that have been planned, and which were accelerated through supplemental appropriations, have been implemented in time for the hurricane season, and that we've increased the number of forecasters in the National Hurricane Center. And we thank you for your support in that regard.

We've implemented new techniques for hurricane track and intensity forecasts, and have the workstation software online to bring those to the fingertips of the forecasters at the National Hurricane Center. And, last, but not least, we have coordinated the numerous outreach activities, and we feel we're ready for this season.

PREDICTION OF FUTURE STORM ACTIVITY

Senator SHELBY. Last year was the strongest hurricane season on record, with 15 hurricanes, 4 of which were category 5, and 4 making landfall. Doctor, given Admiral Lautenbacher's statement regarding the forecast for 2006, do you expect a continued increase in storm activity? And, if so, for how many years? I know it's a prediction.

Dr. UCCELLINI. Well, the numbers that we're predicting have been brought forward, and they are less than what we had last year.

Senator SHELBY. Less?

Dr. UCCELLINI. They are less than what we actually had last year. But the prediction we made in May of last year, and updated in August, was also less than the actual number of storms that occurred in 2005. And one of the important factors that the folks in the Climate Prediction Center, who also work for me, said that the numbers that we're predicting right now are actually larger than the numbers we brought forward in May of last year. So, the bot-

tom line here is that we are expecting an active season. The conditions are ripe for an active season. Whether we approach the record season we had last year is something that our forecasters are not willing to put forward at this point.

We will update this forecast in August, as we are in the middle of the season.

Senator SHELBY. Last year, your predictions were, I thought, so accurate, considering it is a prediction. I know you can't forecast everything in the future, but do you believe you have the tools to improve on your forecast and so forth?

Dr. UCCELLINI. Well, the forecasting of any weather event is a very difficult scientific problem.

Senator SHELBY. It is.

Dr. UCCELLINI. And, clearly, the more observations we have, the better we make our models, which are based on mathematical and physical principles, the larger the computers that we can bring to solving those problems on an on-time basis. This is something we have to do in real time, so we strive for those improvements. So, yes, we do a good job. We have the verifications to show that our forecasts are improving, but there are a lot of issues still facing us that we know we have to deal with, from a purely scientific point of view and also a technological point of view, to continue to improve those forecasts.

STAFFING FOR FORECASTERS

Senator SHELBY. Admiral, what about the staffing situation at NOAA, for forecasters throughout the National Weather Service? Is it adequate? Do you need more? Senator Mikulski and I want to make sure you have the adequate resources, because the way your agency performed is exemplary.

Admiral LAUTENBACHER. Thank you. And I appreciate that. We have been very fortunate in being able to increase, because of your action, the number of forecasters in the Hurricane Center by four, whom we promoted from within the organization. We are in the process of making sure that all of the backfills for those people have been promoted, who are fully staffed—that the forecasting group is fully staffed for hurricanes this season. We continue to ask for support on the pay raises, because there has been some leveling off of our ability to provide backfill for pay raises when they are absorbed in the general budget. And so, the administration did ask for increases in pay raises for our forecasters this year, and I commend that, again, in the interest of the subcommittee. I think it's very important for our morale.

Senator SHELBY. You've got to keep the good people.

Admiral LAUTENBACHER. Yes, sir.

HURRICANE SEASON PREPAREDNESS

Senator SHELBY. I understand that NOAA recently participated in some of the gulf States' emergency management workshops as an essential Federal partner in the hurricane preparedness process. What's your opinion on how the gulf States are preparing for the coming hurricane season, particularly with respect to the lessons learned from last year? Which one of y'all want to take that?

Admiral LAUTENBACHER. Well, maybe we can both——

Senator SHELBY. Both, okay.

Admiral LAUTENBACHER [continuing]. Both contribute. I have been down to the gulf coast personally to tour our facilities and talk to people, and I think there is new recognition, and very serious concern, about preparing, this year. And I've talked to several of the State directors. I know that Max does that all the time. So I don't want to be complacent. I want to continue to get people serious about it, because I know there are always a few that don't get the word. But the fact is, I think, that awareness is much higher, and we're preparing to help them as much as we can this year.

Senator SHELBY. Where are you, as far as helping the people in the gulf coast, and everywhere, to develop construction standards for hurricane-resistant structures and shelters? All of that's important.

Admiral LAUTENBACHER. It is very important, and we have a joint committee with NIST, the National Institute of Standards and Technology, which is part of the Department of Commerce—to take our modeling and look at their structural models—because they're the ones that have to determine what these standards are. So, the issue here is to go from large-scale models that tell what's going on in an area for winds and surge, and turn it into something that can be done locally and looked at by the structural engineers at NIST. And we are very dedicated to working on that problem with them.

Senator SHELBY. Doctor, do you have anything to add to that?

Dr. UCCELLINI. Well, I was just going to add, on the outreach at the State and local levels, that the National Weather Service, Southern Region, headed by Bill Proenza, and the Eastern Region, headed by Dean Gulezian, have been very active in working with the State and local emergency management and other responders, first responders, with respect to reacting to the hurricane warnings and warnings that are associated with them. So, the National Weather Service has been active in our outreach—they do this every year, but this year, particularly, has been a focus. And I know that the staff in these forecast offices and in the regional offices have been right there all off-season to deal with these issues and making sure that the communities are ready.

Senator SHELBY. I understand that NOAA works with FEMA, the U.S. Geological Survey, the U.S. Corps of Engineers, and other Federal and State agencies, to assure a coordinated effort on preparedness for hurricanes and coastal flooding. Do you feel there has been significant coordination between all State and Federal agencies as we enter into this new hurricane season?

Admiral.

Admiral LAUTENBACHER. I do. I have seen a lot more coordination, starting with the White House and working down into the local region. Response plans have been developed. The season has actually been sort of war-gamed at the highest level, at the Cabinet level, in which we've been involved. And we have participated, as Dr. Uccellini mentioned, at the local level, as well as at the Federal level. So, there has been, in my view, an enhanced degree of coordination and cooperation this year. I, personally, have talked to the new FEMA Director, and we've set up new coordinating bodies to

work together to look at the response that comes after a hurricane. And I'm feeling that we're moving in the right direction.

TECHNICAL SUPPORT

Senator SHELBY. What technical support or tools does NOAA provide during the rest of the year, to help the State and local governments undertake hazard mitigation, actions, and prepare communities?

Admiral LAUTENBACHER. It's ongoing. It's ongoing all year. I know if Max Mayfield were here, he would tell you about the activities that he takes outside of the hurricane season. As he's always said, the preparedness for this hurricane season takes place in the off season. He spends a great deal of time on the road, as many of our folks do, talking to, and making personal appearances. It is not just the hurricane awareness tour that I've talked to you about. So, there's a great deal of outreach that goes on continuously, year round, from our folks. Now, we have the StormReady Program, which is exceedingly important. Every weather forecast office in our Nation is available. They have a warning coordinator/meteorologist, who talks continuously to the county and city managers in that area, and who provides checksheets and ways to certify that county and city that they are ready and prepared for any emergency event, and that doubles—goes double along our coasts.

Senator SHELBY. I also understand that NOAA has begun work—and probably has, in the past—in communities to create and improve their coastal inundation maps. How is this effort coordinated with updating the FEMA floodplain maps? And are the NOAA maps being created using the latest technologies, topography, and data and so forth? This is very important in another committee, the Banking Committee. You know we are working on the Flood Insurance Program there. Mapping is so important to all of it, is it not?

Admiral LAUTENBACHER. It's critical. And we work very closely with the Flood Hazard Mapping Program. We provide the elevation data, and we provide some of the charting of the coasts, and our models help determine the floodplain areas. That information all goes to FEMA and to the cognizant parts of State and local agencies.

Senator SHELBY. So, that'll ultimately wind up in the zoning and building codes, hopefully?

Admiral LAUTENBACHER. It should.

Senator SHELBY. In the local communities?

Admiral LAUTENBACHER. It should wind up in the zoning and the building codes. Again, much of the zoning and building codes are local——

Senator SHELBY. We know.

Admiral LAUTENBACHER [continuing]. Are local issues, and we work, to our utmost, to ensure the information is available to all local/regional emergency managers.

Senator SHELBY. Do you know if any of the coastal communities—and I'll speak from the gulf perspective, and let Senator Mikulski do the other, from the East have they adjusted their land use as a result of any of your maps?

Admiral LAUTENBACHER. I am not aware of that. I'm really not informed enough to answer the question.

Senator SHELBY. But, ultimately, they——

Admiral LAUTENBACHER [continuing]. Take it back——

Senator SHELBY [continuing]. They should look at everything, from——

Admiral LAUTENBACHER. They should.

Senator SHELBY [continuing]. From flood and a propensity of hurricanes, everything, should they not?

Admiral LAUTENBACHER. Absolutely.

EVACUATION ROUTES

Senator SHELBY. What about evacuation routes? Have you worked with FEMA, anybody, on that, in the States?

Admiral LAUTENBACHER. We do work with evacuation routes with the emergency managers. It's particularly important in the tsunami work that we've been doing, where there is more vulnerability on the west coast, but it's something that every coast should be dealing with. Evacuation routes are part of the certification for StormReady, so we work with the emergency managers in each area to ensure that they have looked at the emergency routes. Our folks are not necessarily the experts, but they can provide the information on what makes sense.

Senator SHELBY. I have some other questions, but I'm going to now recognize Senator Mikulski for any questions.

NATIONAL CENTERS FOR ENVIRONMENTAL PREDICTION

Senator MIKULSKI. Thank you very much, Mr. Chairman. Many of your questions are also mine.

But I'd like to turn to Dr. Uccellini and ask this. We hear about the National Centers for Environmental Prediction. And what I'd like to share with my colleagues, this is not only—the Center is not only limited to hurricane prediction. What else goes on there?

Dr. UCCELLINI. Well, we have seven service centers that involve basically everything from the Sun to the sea. We have the Space Environment Center in Boulder, Colorado. We have the Storm Prediction Center and the Tornado Watch Program in Norman, Oklahoma; the Aviation Weather Center, in Kansas City. We have the Tropical Prediction and the National Hurricane Center in Miami. And then, in Camp Springs, Maryland, we have the Climate Prediction Center; the Hydrometeorological Prediction Center, which does the quantitative precipitation forecasts that are used for the inland flooding problem; and then, the Ocean Prediction Center, which is a critical part of our forecast infrastructure. Many of these storms, obviously, are over sea, and the Nation's commerce is really dependent upon the ships at sea, so the Ocean Prediction Center is involved in differentiating your normal storms from your gales and your major storms. So, there's this whole range of activities that are then supported by the modeling and the infrastructure of getting this global data from the global observing system to the models on time, getting the information out of the models, getting the information from all of these forecast centers out to not only the general public, but the private sector, our local forecast offices, et cetera. So, that's the whole range of what we do.

Senator MIKULSKI. So, first of all, NOAA isn't like a Government agency talking to another Government agency about hurricanes;

that essentially, for our colleagues in the Senate, what the National Centers for Environmental Prediction does is, serve the Nation, serve us coastal Senators that are hurricane impacted, serve the western Senators in helping to predict the factors that could be creating wild—a high level of possibility for wildfires, the tornado predictions, working with the private sector, particularly with aviation prediction—when's it safe to take off? What are the weather conditions, and so on? Is this—so that NOAA really serves the Nation in any kind of weather impact, from school closings to airport closings. Am I——

Dr. UCCELLINI. That's correct. One of the partners that I haven't mentioned in this is the media, for example. And we have strong partnerships with them across the whole line. And so, they access our products directly. So, what I'd like to say is, basically, from the National Centers for Environmental Prediction's point of view, all the forecasts you see here and read about start with us. They don't end with us, but they start with us. We provide that critical information that allows these folks to get that information out.

Senator MIKULSKI. But your customer is not only other Government agencies, it is, number one, other Government agencies for readiness, response, repair; the second is also the private sector, like in the field of aviation, cargo shipping, lost cargo, a Valdez, anything that could have come from weather would be impacted; and then also ordinary people, themselves, who have to know what to do.

Dr. UCCELLINI. Right.

Senator MIKULSKI. And the media is your best friend for broad distribution. Is that right?

Dr. UCCELLINI. That's correct.

INFORMATION PROCESSING AND PREDICTION CYCLE

Senator MIKULSKI. Now, what—and then, you do this by observing, through satellites and land sensors and ships at sea, et cetera. Then that information comes to the National Centers for Environmental Prediction. Then it's processed, and then sent down, in the case of hurricanes, to the Hurricane Center, who then value-adds. Is that the way it works? Observation, process, down to the appropriate center, where even more is added to it, and then back out to the appropriate public/private and ordinary citizen——

Dr. UCCELLINI. That——

Senator MIKULSKI [continuing]. Is that the way it works?

Dr. UCCELLINI. That's the way it works. And it works on a cycle of four times per day. Every 6 hours, we repeat that cycle.

Senator MIKULSKI. Four times a day——

Dr. UCCELLINI. Right.

Senator MIKULSKI [continuing]. Every 6 hours. So, you're operating 24/7.

Dr. UCCELLINI. Right.

Senator MIKULSKI. It's just not like you're sitting around—and I don't—please, don't—and then, when you think something might happen, and you all come alive.

Dr. UCCELLINI. We have to be ready all the time. We're predicting all the time. We have to be able to tell emergency managers, or anybody, when it's not going to storm, just as much as

when it is going to. And, we like to point out, for the United States, which, as a country, has more severe weather than any other country in the world, that there's always something happening in this country that our forecasters have to deal with.

Senator MIKULSKI. Twenty-four/seven, six times a day, all these predictions——

Dr. UCCELLINI. Four times a day. We're on a 6-hour cycle——

Senator MIKULSKI. Yes, I'm sorry. Got it.

Dr. UCCELLINI [continuing]. Four times a day.

HURRICANE PREDICTION MODEL

Senator MIKULSKI. Okay, now, let's go to this new hurricane prediction model. After Katrina, I think we knew you were working on a model, and this subcommittee, under Senator Shelby's leadership, provided increased funding to accelerate the model. Could you tell us where you are in the new hurricane model and what will the public get for this new model?

Dr. UCCELLINI. Right. We're in the process now of actually testing that model on individual cases. And when I say "testing," what's new about the model is not just the physics that we bring in from an atmospheric point of view, it's the coupling with the ocean on a real-time basis that is actually being tested. And our plans originally were to implement that and replace the existing model in the 2008–2009 timeframe. And what our plans call for now is to get that into operations by 2007. So, we were looking at a 2-year acceleration——

Senator MIKULSKI. But what will it do?

Dr. UCCELLINI. What it will do is——

Senator MIKULSKI. What will it do—what will the new model do that is different than the old model?

Dr. UCCELLINI. Okay. Well, first of all, we expect more accurate forecasts for the track and, more importantly, for the intensity of these storms. I think everybody knows we've made significant improvements in track forecasts over the past 10 years, but the intensity forecast has proven to be a particularly thorny issue, from a science point of view. And, in fact, we've had a working group now, working with the NOAA Science Advisory Board, to bring forth recommendations, and they're all focusing on increased resolution of the models, which this will have. So, we expect that, with the improvements we're working on, and working with the larger scientific community, that we will be addressing this intensity issue. Many of these storms intensify very rapidly over a 12-hour period. We saw that with Charley off the coast of Florida, we saw that with other storms in the Gulf of Mexico. We saw that Wilma went to a category 5 in less than 24 hours. We have trouble forecasting those intensity changes. And then, of course, the de-intensification as it approaches the coastline is also a critical issue. And we expect this new model to give us a better handle on the intensity changes.

Senator MIKULSKI. I want to come back to intensity and surge, but just a question. Won't the new model give you a more accurate prediction as to where a hurricane will come down? I mean, the private sector tells me that, for every mile of evacuation, colleagues, it cost $1 million. So, when you hear, "Oh, they're leaving Key West," or, "They're leaving Ocean City," every mile of evacu-

ation costs about $1 million, in terms of closing businesses, disruption, overtime for State troopers, et cetera. So, if we know whether—if it's going to hit Savannah or Charleston, you know, Norfolk or Maryland, I mean——

Dr. UCCELLINI. Yes, we do expect better forecasts for the track, as well. We have been making improvements on track, so the delta in the track forecasts won't be as large as, we hope, for the delta in the intensity forecasts. But, let me add that one of the issues with forecasting these storms, as you approach landfall from 5 days in advance to 4 days in advance, to 3, to 2, to 1, is, you want a consistent forecast. You don't want the models to be moving all over the place as a hurricane is approaching land. And another issue that we expect to be able to address with these high-accuracy models, is that they'll give us more consistent forecasts on a run-to-run basis.

SURGE PREDICTION

Senator MIKULSKI. Well, also, will this give us greater prediction, in terms of surge? You know, when Isabel hit Maryland, I went to bed thinking we had dodged the bullet of the hurricane, only to wake up to find out we were kayaking in Fells Point, and, you know, I was commuting by Zodiac that day. Not literally, but——

Dr. UCCELLINI. Well, it was the Isabel storm that brought great attention to the storm surge models and the improvements that needed to be made there. And we are addressing current surge models, and improving those, as well. But, with this new modeling system, what we are approaching now is the ability to fully couple the atmospheric model with the ocean and coastal model.

Senator MIKULSKI. Is surge in this new model?

Dr. UCCELLINI. It will be in the new model in the extended timeframes. We're not confident yet that it will be in the model for 2007, but that is an issue that we're addressing. And when we feel like we can improve upon the existing surge model, then it will go operational.

Senator MIKULSKI. My time is running out, so I'm going to ask—I understand, from the employees, you need about—you know, in Maryland, you can't go to a supermarket without talking to five Federal employees, all working on projects, writing the regs, and so on. They tell me that, really, the weather—to do the new model, you need about another million dollars for 2007 to do about six more people to complete the job. Is that right?

Dr. UCCELLINI. With your support, we're building up the modeling group to do the hurricane improvements. And we have plans for sustaining that. In 2007, we'll have to look within NOAA to do that, but, in 2008, we are, you know, approaching that budget cycle and looking to fully support——

Senator MIKULSKI. So, what's——

Dr. UCCELLINI [continuing]. The model——

Senator MIKULSKI [continuing]. The answer to the question, though, Doctor? Or are you unable to answer it because of——

Admiral LAUTENBACHER. Let me——

Senator MIKULSKI [continuing]. OMB rules?

Admiral LAUTENBACHER. We're——

Senator MIKULSKI. All I need to know is, Do you need another million dollars for six people to complete—to really work to complete——

Admiral LAUTENBACHER. We're going to make sure he has the six people to start this when it needs to be started, and we're going to ask for the budget resources on the next cycle to increase this effort.

HURRICANE LIAISON TEAM

Senator MIKULSKI. Okay. This is my last question, Mr. Chairman.

I understand that, at National Hurricane Center, there is something called a "hurricane liaison team," and that that liaison team has appropriate government agencies, particularly FEMA. Could you tell us what the hurricane liaison team is at the Hurricane Center, or in conjunction with, and was it operation during Katrina? And what did it do?

Dr. UCCELLINI. Yeah, the——

Senator MIKULSKI. And how will it be different next time?

Dr. UCCELLINI. Right. The hurricane liaison team was actually formed in the 1990s, after Andrew. And part of this effort to get one voice out to the emergency management community. It was recognized back then that we needed to do that with FEMA and with the State and local emergency management teams.

Senator MIKULSKI. This was out of Andrew. Am I right?

Dr. UCCELLINI. It was part of the feedback we got from the Andrew storm, that's correct.

Now, the liaison team contains a FEMA work area at the Hurricane Center. So, they have a work area. It's right off of the forecast floor. They have all the technical abilities in that work area to access the forecasts, even as they're being made. The briefings that are done for the larger FEMA organization—and they include State and local emergency management officials in those briefings—the weather portion of those briefings are actually orchestrated, led out of that liaison team in Miami. They lead the entire briefing, and they include other components of the Weather Service, including the Hydromet Prediction Center, at Camp Springs, that talks about the rainfall prediction, and the River Forecast Centers which predict floods. So, all of that is done. It was working very well during the last hurricane season. And I actually attend those briefings, although I don't participate. I have two Center directors——

Senator MIKULSKI. So, during——

Dr. UCCELLINI [continuing]. That do.

Senator MIKULSKI [continuing]. Katrina, when we all—all of America watched Katrina coming. I know I certainly was. I happened to be on the Eastern Shore at the time and saw these predictions. So, there was a hurricane liaison team. They were working right alongside with the predictors, the science——

Dr. UCCELLINI. Right.

Senator MIKULSKI [continuing]. Community. And then, their job was to notify everybody to be ready, to stand sentry. And they were getting this most accurate, realtime, uptime predictions.

Dr. UCCELLINI. That's correct. And at 12 o'clock every day and at 5 p.m. there is a briefing that's provided, and the whole briefing goes out to all the emergency managers in the affected States.

Senator MIKULSKI. Well, are we——

Dr. UCCELLINI. And that's all——

Senator MIKULSKI [continuing]. Saying, then——

Dr. UCCELLINI. And that's all coordinated by FEMA through that liaison team.

Senator MIKULSKI. Are we saying, then, that all of these States were appropriately notified at the velocity that was coming their way, in addition to watching it on TV?

Dr. UCCELLINI. The emergency management teams in each one of those States participated in those calls at 12 and 5 p.m. every day.

Senator MIKULSKI. Well, Mr. Chairman, I think we need to talk about it. Something broke down.

So, in other words, we want this hurricane liaison team.

Senator SHELBY. Absolutely.

Senator MIKULSKI. But, if they, then, knew it, then what happened? And—do you have any thoughts or——

Dr. UCCELLINI. I'll just say that I was part of the Weather Service headquarters at the time the hurricane liaison team was spun up. We all recognized that this was the way to conduct business with one of our primary users of our information. And I consider that a very important aspect of the work that we do as part of the U.S. Government.

Senator MIKULSKI. Oh, it certainly is.

Well, my time is really up. And we want to thank you, again, for the wonderful work that you do, because it's really dedication. If you don't have the right people, the right technology and models won't work. And, also, we want to thank you for the consequence management, about the aerial images afterward, this—the consequences on coastal impact, the materials—I mean, what happened out in the gulf, with oil——

Dr. UCCELLINI. That's right.

Senator MIKULSKI [continuing]. And all of that, our impact on fisheries, which we haven't even talked—your satellites could work with us. So, it's a—it was a great job, and we want to thank you for it, and hope for the best for this year. Thank you.

Thank you, Mr. Chairman.

Senator SHELBY. Senator Murray.

TSUNAMI PREPAREDNESS

Senator MURRAY. Thank you, Mr. Chairman. And thank you, to both of you, for having this really important, informative hearing.

I wanted to just take an opportunity, while you were in front of this subcommittee, to ask a question on a related issue, on tsunami preparedness. You mentioned a minute ago, my coast does worry about that. And after the 2004 Indian Ocean tsunami, it really raised a lot of concerns about the vulnerability of our detection and warning systems so we would not have a similar disaster on any of our coasts. Congress responded well. We appropriated $17.24 million in a supplemental funding bill for NOAA to expand and improve its tsunami detection capabilities and a number of other

things. And in 2006 we appropriated almost $10 million for tsunami-related activities. And this year the President's asked for $21.66 million. So, we're responding to that. But I was really concerned, because the Government Accountability Office (GAO) issued a report on these—U.S. tsunami preparedness just this last Monday that raised some concerns about both the effectiveness of the existing Federal warning system and the progress that's being made to increase preparedness in a lot of our high-hazard areas. And, importantly, the report noted that NOAA has yet to adopt a comprehensive strategic plan that establishes risk-based priorities to guide the expansion of the warning program. Without that kind of plan, GAO said that the ongoing expansion could result in a diversion of critical funds away from locations like the Pacific Coast, where the tsunami hazard is well documented, to areas with little or no risk.

Admiral, if you could just talk for a minute about what your response is to the GAO report and recommendations.

Admiral LAUTENBACHER. We are reviewing the GAO report. We certainly believe in risk-based management. Risk-based management is extremely important. One of the elements of the program is to provide the kinds of flood information and first of all, the coastal bathymetry and topography, so we can tell what the dangerous areas are, and to get enough effort going to be able to map all of these areas. This is the same issue we have with storm surge in the gulf from hurricanes. So, the issue is trying to get the mapping, the risk areas, set up and done in a reasonable way, because we can't do them all at once. And we certainly agree that we need to look at it on a risk-based management perspective, because it's not something that can be done instantaneously for everyone in all areas.

DEEPWATER DETECTION BUOYS

Senator MURRAY. Well, what is the timeline for development of the—more deepwater detection buoys off the Pacific Coast?

Admiral LAUTENBACHER. First of all, the buoys are developed, and they're being delivered. We have 10 buoys in the Pacific that have been put in, and we have put 5 in the Atlantic and Caribbean. This year, we'll reach what we call IOC, or initial operating capability, of deepwater buoys for both the Pacific and the Atlantic. Next year, we will be able to complete the bulk of the 39 that we've committed to put in, so the program is running as expected.

Senator MURRAY. Have all the existing buoys been functional over the last year?

Admiral LAUTENBACHER. We have had casualties to a few of our buoys, and we've replaced them. We still have one that's not functional off the Aleutians, and that will be replaced as soon as the weather cooperates. There is a very narrow weather margin.

Senator MURRAY. Right.

Admiral LAUTENBACHER. What we're going to do in the Aleutians is put two buoys in each of those stations, to try to provide the required reliability, so that there will always be one on station. In other places, we can service them at more regular intervals than we can in the Aleutian Islands.

Senator MURRAY. Okay. Well, I appreciate that. And if you could maybe just, in writing, get back to the subcommittee on what kind of gaps remain and what we need to do to address them, because I was very concerned when I saw that GAO report, and the impact it could have on our being prepared for a tsunami on any of our coasts, but particularly where I live, out in the—out in Washington State. So, if you could——

Admiral LAUTENBACHER. I'd be pleased to do that.

[The information follows:]

ADDRESSING THE GAPS REMAINING IN TSUNAMI PREPAREDNESS

In response to the December 2004 Indian Ocean Tsunami, the Administration has made a commitment to strengthen the Nation's tsunami warning program. The fiscal year 2007 budget request continues the Administration's commitment to this mandate—with its goal to eliminate "gaps" in our ability to accurately and effectively detect tsunamis, issue timely and effective warnings and mitigate tsunami hazards through community-based tsunami preparedness programs. The overarching focus of this multi-year effort embraces the three integrated components of the National Tsunami Mitigation Program: (1) Improving Tsunami Warning Guidance; (2) Improving Tsunami Hazard Assessment; and (3) Improving Tsunami Mitigation. Financially, NOAA's initial efforts in strengthening the U.S. Tsunami Warning System have been on improving tsunami warning guidance. This has included expanding NOAA's Deep-ocean Assessment and Reporting of Tsunamis (DART) network, expanding/upgrading NOAA's sea-level reporting network, expanding and upgrading NOAA's seismic networks, and upgrading the operations of NOAA's two Tsunami Warning Centers to 24/7 operations. Funds provided to the U.S. Geological Survey (USGS) have led to improved global earthquake detection and faster reporting of earthquake data for tsunami warning.

NOAA is also expanding and accelerating its tsunami inundation, mapping, modeling and forecast efforts. NOAA has embarked upon an accelerated and expanded program to collect bathymetric data along vulnerable U.S. coastlines and develop detailed community-based tsunami inundation maps and tsunami inundation forecast models for the most at-risk U.S. coastal communities (74 total models). By the end of fiscal year 2006, we are scheduled to complete 8 additional models, for a total of 17. With sustained funding, 9 more models will be added in fiscal year 2007 and the forecast operating system software will be transferred to the tsunami warning centers. We project completion of this national effort during fiscal year 2012.

In response to its mandate to improve tsunami mitigation/preparedness NOAA has increased the number of TsunamiReady communities/locations to 27, which is an 80 percent increase above the December 2004 number. NOAA is committed to working with every at-risk community to help make them TsunamiReady.

The GAO Report focuses primarily on tsunami preparedness and hazard mitigation and proposes the following recommendations—all of which NOAA is adopting:

—Work with the Federal Emergency Management Agency (FEMA) Director and the USGS Director to create standardized tsunami loss estimation software to help communities determine the potential impact of tsunamis and identify appropriate mitigation actions;

—Reduce the number of tsunami warning false alarms by (1) completing the planned expansion of tsunami detection stations, (2) reexamining NWS's rules dictating when a warning will be issued and to what areas, (3) establishing a routine process for other federal and state experts to formally review and comment on the center's use of seismic data, and (4) setting performance goals to guide improvements;

—Work with the states to conduct periodic end-to-end tests of the tsunami warning system, including NOAA Weather Radio and the Emergency Alert System, to ensure the system will function as intended during a tsunami emergency;

—Evaluate the TsunamiReady program to determine what barriers, if any, exist to participation and what modifications are needed to encourage more high-risk communities to participate;

—Evaluate the National Tsunami Hazard Mitigation Program (NTHMP) to determine what has worked well in the past and what high priority activities remain to be completed and to help inform strategic planning efforts;

—Develop comprehensive risk-based strategic plans for the Tsunami Program and NTHMP that consider input from states and federal partners and include metrics for measuring progress toward achieving program goals.

We will forward for the Committee's review a copy of the DOC/NOAA response to the GAO Report as soon as it has been cleared. Our response to the GAO report will acknowledge that NOAA's focus will remain on the high risk locations. As the GAO acknowledges, achieving comprehensive community-based tsunami preparedness programs for all at-risk U.S. coastal communities will require an integrated effort of multiple Federal Agencies (NOAA, USGS, FEMA, and the National Science Foundation) and State and local government participation to achieve program goals.

NOTIFICATION OF GOVERNORS

Admiral LAUTENBACHER. And regarding the point about making sure that everybody is prepared—I have been asked by the House Appropriations Committee to call every Governor to tell them the status of the program, which I have done, and I have contacted your Governor, as well as those in——

Senator MURRAY. Thank you.

Admiral LAUTENBACHER [continuing]. Oregon and California—and will continue—I take this very seriously, and we will continue to do everything we can to provide the Federal piece of the warning system. Thank you for——

Senator MURRAY. Thank you——

Admiral LAUTENBACHER [continuing]. Your attention.

Senator MURRAY [continuing]. Very much. Appreciate it.

WEATHER PREDICTION

Senator SHELBY. I have some more questions, for the record here, and I'll try to run through them.

What are the U.S. strengths and weaknesses in weather prediction, Admiral?

Admiral LAUTENBACHER. Okay, from my perspective, I think that we are very strong in our observing systems. We have good satellites. We have good control of the assets that we use. We have excellent prediction centers. So, the strengths, in terms of the ability to bring science into an operational part of our setup, are extremely good. We have good international relationships. We take advantage of other——

Senator SHELBY. How do we——

Admiral LAUTENBACHER [continuing]. Information——

Senator SHELBY [continuing]. Compare with Europe as far as predictions?

Admiral LAUTENBACHER. I think we're on a comparable footing. It's not exactly an apples to oranges comparison, but we do well. Now, Europe has a different mechanism. They've——

Senator SHELBY. Sure.

Admiral LAUTENBACHER [continuing]. Combined their agencies to have a European Center for Medium Weather Forecasting.

Senator SHELBY. They have different risks, too, don't they?

Admiral LAUTENBACHER. Sir?

Senator SHELBY. Have different risk.

Admiral LAUTENBACHER. How the different——

Senator SHELBY. The risk is different in Europe.

Admiral LAUTENBACHER. Certainly, the risk is different——

Senator SHELBY. Yeah.

Admiral LAUTENBACHER [continuing]. In Europe. They have different storms and types of weather conditions to worry about. But I am always interested in creating bigger and better modeling cen-

ters, more computing power. So, I think we need to work, in the future, on developing our computing power. I've brought that recommendation forward within the administration, as well as within the scientific community.

Senator SHELBY. How do you intend to integrate new remote sensing technology to advance your Nation's storm forecasting?

Admiral LAUTENBACHER. Remote sensing capability can be difficult, because there's a large amount of information that comes in from this technology. So, what we have created is a Joint Center for Data Assimilation with NASA and the Department of Defense to take this data into a single combined organization that allows us to then parse it out and put it in models. Dr. Uccellini is a key part of that issue of incorporating new data as quickly as possible into our models.

Senator SHELBY. As both of you well know better than I, severe weather comes in many forms, not just hurricanes. So far this year, 724 tornados have been reported in the United States, according to NOAA's Prediction Center. Preliminary reports show these events have resulted in at least 52 deaths. I understand that you're working to ensure that citizens are better informed about dangerous weather, because it saves lives, saves property and everything else. What's the most effective strategy for decreasing severe-storm-related deaths, in your judgment?

Admiral LAUTENBACHER. In my judgment, it's preparation, it's people understanding what the risks are and being prepared to act when they get information. And next, they need the information, and I'm always advertising NOAA Weather Radio as a way to get the information.

STORM SURGE FORECASTS

Senator SHELBY. During Hurricane Katrina, much of the damage in my State of Alabama, and a lot more in Mississippi, was caused by storm surge. In some communities, the water levels were higher than 20 feet. Can you tell us what NOAA is doing to improve storm surge forecasts? And how can you highlight some efforts to improve forecasts for inland flooding caused by heavy rains during hurricanes, you know, as the aftermath of this?

Admiral LAUTENBACHER. Yes, and as we mentioned, we have a model called SLOSH (Sea, Land and Overland Surges from Hurricanes), that we use today. It's a rudimentary model, but we are trying to make it better.

Senator SHELBY. Is it working?

Admiral LAUTENBACHER. It works. Yes, it does work. Does it work accurately all the time, in every place? The answer is——

Senator MIKULSKI. No.

Admiral LAUTENBACHER [continuing]. No. So, we need to improve it. You have given us some funding to help us do that.

Senator SHELBY. You need more funding in that area?

Admiral LAUTENBACHER. I think——

Senator SHELBY. Senator Mikulski was asking you a specific—I'm going to ask you a specific—do you need more——

Admiral LAUTENBACHER. I think we have the money we need to improve that model, and I would like to have Dr. Uccellini and our folks work on——

Senator SHELBY. Work with the staff.

Admiral LAUTENBACHER [continuing]. The improvements——

Senator SHELBY. The model.

Admiral LAUTENBACHER. The model, itself.

Senator SHELBY. Okay.

Admiral LAUTENBACHER. Because we have some money to improve that model, and we have some money to incorporate better models, in the future. So, you have given us help in doing that, and we are grateful for it, and we're going to take action on it.

COASTAL ZONE MANAGEMENT ACT

Senator SHELBY. The Coastal Zone Management Act requires NOAA to assist States in managing coastal development in order to minimize the loss of life and property caused by improper development in hazardous areas. You know, there's a lot of horror stories here. Under the Coastal Zone Management Act, each State receives approximately $2 million annually to address coastal hazards, in addition to other competitive priorities, such as water quality and public access. Is the Coastal Zone Management Act funding providing enough to achieve the goals of the act, is this just a pittance?

Admiral LAUTENBACHER. That's a very broad question. It has worked fairly well, because the object of the act was to develop consistent plans between the Federal and the State governments so that we would have a consistency principle around the coast.

Senator SHELBY. Sure.

Admiral LAUTENBACHER. Now, if you ask the States, they will tell us that they can always use more, certainly, in working in these areas. But the object of the act was to try to build a consistent plan that allows us to develop properly and with some consistency around our Nation, and that seems to be working fairly well. The act, itself, is well constructed.

Senator SHELBY. Are States afforded sufficient authority to establish priorities for the selection and funding of coastal hazards mitigation projects?

Admiral LAUTENBACHER. I think the act represents the——

Senator SHELBY. In other words, do they have the power?

Admiral LAUTENBACHER. Yes, they do. There is a reasonable balance for them to act and provide the money for projects that they think are important to them.

Senator SHELBY. NOAA struggled to release funds in the previous December 2005 supplemental, but we were assured by the Secretary of Commerce that that's been resolved. Does NOAA foresee any problems distributing funds from the latest supplemental?

Admiral LAUTENBACHER. No, sir, we do not. From the most recent one that was given to us in December, we have distributed all of those funds, and we are preparing so that, when the next one is ready, we will spring into action. We have set ourselves up to try to do it as quickly as possible.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION PRIORITIES

Senator SHELBY. As both of you know, we're working on the 2007 appropriations bill—Senator Mikulski and our staff and members of the committee. But in supporting your overall mission to monitor

and to forecast hurricanes, which we believe is very important to the American people, what are your top priorities, just in a nutshell?

Admiral LAUTENBACHER. My priorities, first of all, are to take care of the people. We have to recognize that, while we have these wonderful technological inventions that we use, it's the skill of the forecasters in using that information that's critical. I'm delighted that we have a good union that supports the work that we do. And to support the people that we have is my top issue.

Beyond that, I would like to make strong representation for our satellite programs. Our satellite programs are critical to the Nation, and we spend a lot of time working on trying to keep them going. So, the increases for the satellite programs are very important. And then, the sensors and the modeling programs that we have.

I think those are all critical, and there are increases for each of those in our 2007 budget.

Senator SHELBY. Well, during the hurricane season, I think you—NOAA stood out as doing great work, wouldn't you think, Senator Mikulski? And we want to commend you, again, for that, and we want to make sure that you have adequate funding to carry your job out.

We thank you both for your cooperation with the subcommittee. We'll continue to work with you.

We have some Senators that are tied up on the floor that have asked to submit questions to you for the record, and we'd ask that you respond to them no later than July 22, 2006.

CONCLUSION OF HEARING

And, other than that, this subcommittee will stand in recess.

[Whereupon, at 11:28 a.m., Wednesday, June 7, the hearing was concluded, and the subcommittee was recessed, to reconvene subject to the call of the Chair.]

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